**MINOR ELEMENTS IN PLAGIOCLASE IN EVOLVED LUNAR CRUSTAL ROCKS** I. S. McCallum, J. M. Schwartz, and H. E. O'Brien, Department of Geological Sciences, Box 351310, University of Washington, Seattle, WA 98195 (e-mail: mccallum@u.washington.edu)

Rocks of the highlands magnesian suite (HMS) and highlands alkali suite (HAS) and their evolved differentiates comprise the major component of the lunar crust in the Imbrium and Serenitatis regions (1, 2). The parental magmas of these suites formed early in lunar history by complex processes involving internal melting and crustal assimilation. Snyder et al. (3) have shown that fractional crystallization of KREEP basalt magma can produce cumulate compositions comparable to those of the HMS and HAS. Papike et al. (4) have confirmed the KREEPy nature of the parental magmas.

The minerals in HMS and HAS samples preserve a record of the latest episodes of their thermal and shock history and many samples show evidence of having formed in near surface plutons (5). Compositions of these minerals can be inverted to calculate parental magma compositions *assuming that subsolidus reequilibration has had a negligible effect on the distribution of minor and trace elements.* Doubts about the validity of this assumption have been expressed (6). In an attempt to address this question, we have begun a program of analysis of minor and trace elements in plagioclase from a number of highlands samples beginning with the analysis of FeO and MgO in plagioclase from some evolved lunar samples that we have previously shown to have formed under near surface conditions. According to Phinney (7), FeO and MgO concentrations in plagioclase are sensitive indicators of subsolidus recrystallization. We also analyzed a suite of samples from the Upper Banded series of the Stillwater Complex to provide an example of a well-characterized plutonic fractionation trend.

Stillwater plagioclases show a relatively flat trend with only slight increase in FeO over a fairly wide range of An contents (Fig. 3). There is textural evidence for annealing and grain growth during subsolidus cooling of the Stillwater Complex and the FeO and MgO data may reflect some elemental redistribution during the slow cooling of this large intrusion. The lunar data show a significantly larger scatter but there appears to be a clear distinction between rapidly cooled (mostly volcanic) samples and the more slowly cooled plutonic samples (Figs. 1 and 2). Magnesian suite gabbronorite 76255 shows a trend parallel to that of the Stillwater but at lower FeO values even though pyroxene compositions indicate similar FeO and MgO values in the parental magmas. 76255 shows textures indicative of annealing, e.g., abundant healed fractures (Fig. 5) and well-formed exsolution textures in pyroxenes. Quartz ferrogabbro 67915 shows considerably more scatter although many of the data lie on an extension of the 76255 trend. The high FeO data points were obtained on a small grain close to an ilmenite and the elevated FeO contents may be due in part to secondary fluorescence.

Rapidly cooled lunar and terrestrial igneous rocks (mare basalt (8, 9), KREEP basalt, Mid Ocean Ridge Basalt) show much steeper slopes on the FeO-An plot (Fig. 4). Although subsolidus reequilibration is not an important process in rapidly cooled samples, it could be argued that volcanic rocks preserve disequilibrium compositions generated during rapid crystal growth. However, the question remains as to whether the compositional data obtained on plutonic rocks can be used to compute the compositions of parental melts. The existing data suggest that care must be taken to ensure that the compositional data represent the magmatic fractionation trend. Since most trace elements in plagioclase occupy the same sites as Fe and Mg, it is important to establish the extent and nature of subsolidus redistribution since this can have a major effect on melt compositions computed by inversion methods

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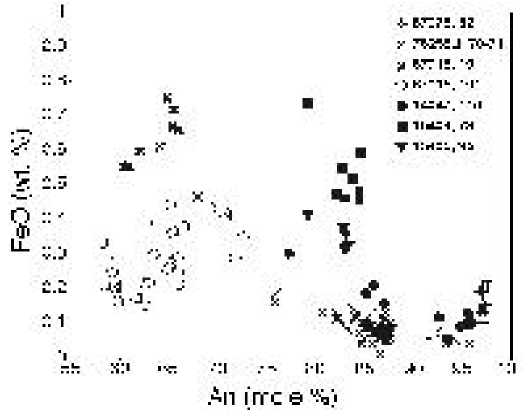


Fig. 1. FeO vs. An in Lunar Crustal Rocks

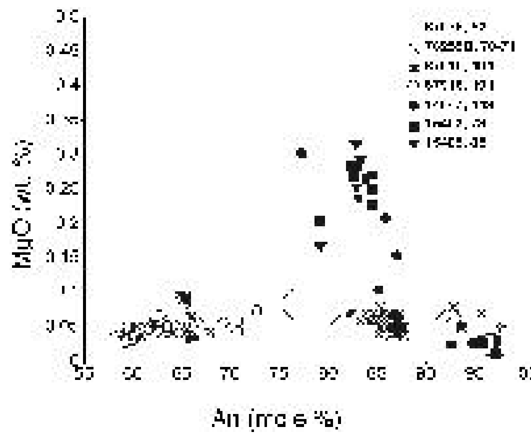


Fig. 2. MgO vs. An in Lunar Crustal Rocks

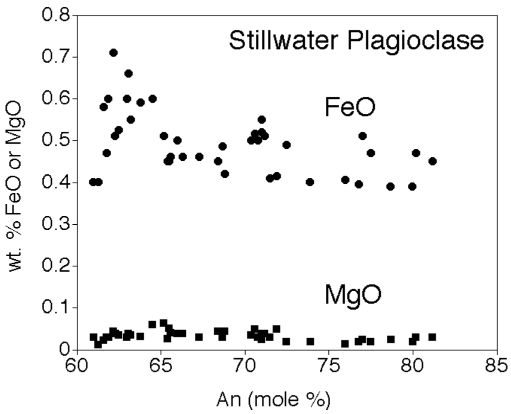


Fig. 3. FeO and MgO vs. An in Stillwater

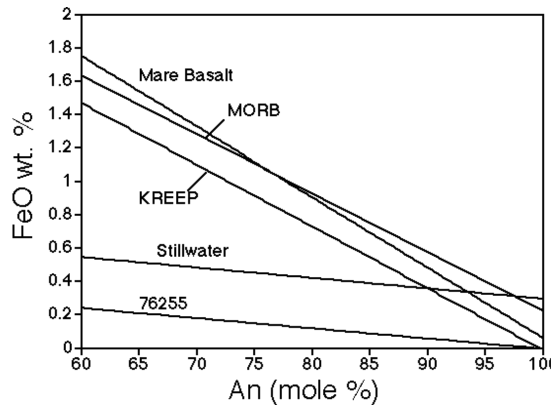


Fig. 4. Avg. trends of FeO vs. An

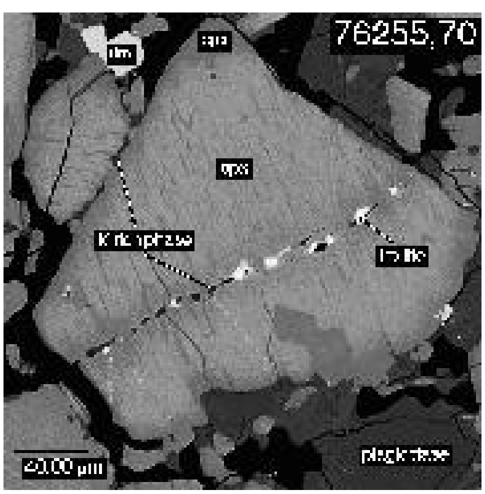


Fig. 5. Grain of orthopyroxene showing healed fractures filled with beads of sulfide and a K-rich phase

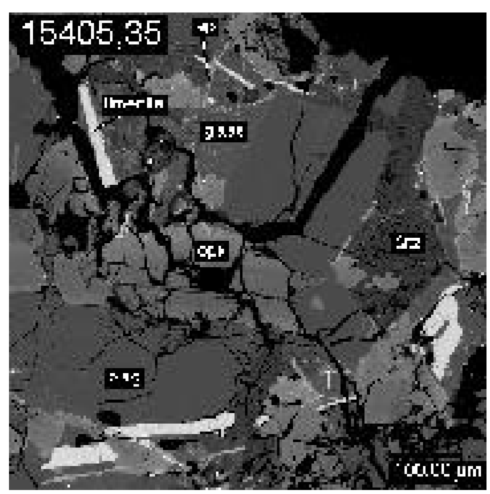


Fig. 6. Clast of alkali quartz norite in KREEP impact melt breccia